Richmond Refinery LPS Bulletin-Reliability FCC- Pit Stop – Deethanizer Bundle Leak (1/8/2012)

IMPACT ERM
Loss ID#30449

Location:
FCC Plant
Cracking Division

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Severe pitting on OD of tubes

Leaking tube identified during hydrotesting of the bundle

Tenets of Operations Violated:

#1- Always operate within design and environmental limits.

#6 – Always maintain integrity of dedicated systems.

#8 – Always address abnormal conditions

#10 – Always involve the right people in decisions that affect procedures and equipment.

Incident Description:

On January 8th, 2012 the FCC unit was shut down to replace the leaking bundle in the deethanizer reboiler, E-142A in-kind. This leaking bundle had been identified on November 2, 2011, when operations detected a hydrocarbon odor in the North GRU of the FCC unit and found the odor was coming from a vent off a condensate pot near C-140B downstream of E-142A. The ABU and HES developed a plan to route this vent to the relief system to prevent uncontrolled venting of the hydrocarbons to atmosphere. By November 3rd, 2011, an Emergency Variance was granted by the Bay Area Air Quality Management District to continue to operate the exchanger under the conditions that the vent continued to be routed to the relief system until the bundle was replaced in January 2012. A TapRooT investigation was started to determine why this bundle had failed.

Investigation Findings:

1) A single tube was found to be leaking during the inspection with severe pitting on OD of tubes. This corrosion had never been seen on the bundle before.
2) The original design of the exchanger allows areas of the bundle and shell to have stagnant or low flow areas. Stagnant or minimal flow regimes in the bundle will cause corrosion due to the ammonium bisulfide. This low flow condition was identified in 1993 during original analysis of exchanger and nothing was done to rectify the issue.
3) From January 2011 to January 2012, there were more instances of high chloride feed to the FCC than had been seen in the previous five year run from 2005 to 2010.
4) During high chloride feed events, excess water was found in V-121 (depentanizer reflux drum) downstream of E-142A. This indicated more water was present in the exchanger.

Lessons Learned:

1) Excess water coupled with higher chlorides in areas already susceptible to ammonium bisulfide corrosion caused accelerated corrosion to occur in the bundle resulting in a failure.

Recommendations:

1) Inspect other areas that maybe at risk for accelerated corrosion due to ammonium bisulfide and the increase in chlorides with water.
2) Redesign E-142A to eliminate low flow areas in the exchanger and install a new unit at earliest opportunity or by 2015 FCC Major startup.
3) Enforce use of RI-703 when supplying FCC with import feeds so that a thorough review is conducted when the feed chloride levels are suspected of being above RI-703 standards..
    1) Develop chloride response plan for the FCC when chloride levels are expected to deviate from RI-703.
    2) Conduct sampling for chlorides in the North Gas Recovery Unit to determine how high chloride feed correlates to chlorides in down stream equipment
4) Evaluate FCC NGRU to determine cause of increased water carryover to depentanizer reflux drum.
    1) Perform Tracer Study or gamma scan on the deethanizer column C-140B to evaluate if column internals are malfunctioning.